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Liliana Bagala' Rampazzo

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EXAMINER

NELSON, MICHAEL E

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

DETAILED ACTION

1. In response to the request for reconsideration filed 05/06/2008, Applicant's arguments have been evaluated but do not place the case in position for allowance as written. Certain claims are allowable, in view of the showing of unexpected results, as discussed previously. Other claims however, are too broad in scope to be supported by the showing of unexpected results.
2. Applicant has corrected the drawings used to show stabilization of the radical anion due to the presence of an additional aromatic ring. Mesomeric isomerization is a substituent effect in which certain **substituents** on aromatic rings have a stabilizing effect on the compound as a whole, but the concept illustrated is closer to classical resonance stabilization of aromatic systems due to bond delocalization. In theory, the more resonance structures that can be drawn, the more stable a system is. In the case of charged compounds, and radicals, the radicals and charges tend to localize as far from each other as possible. Compounds which allow this to occur due to resonance are more stable. While many more resonance structures can be drawn similar to the corrected structures in the latest response, the theory is quite clear.
3. Examiner agrees that the effect of resonance stabilization tends to increase as the number of double bonds increases, and larger aromatic hydrocarbons would predictably have a greater stabilizing effect than smaller ones. However, heteroaromatic systems have different behavior due to the presence of heteroatoms in the ring system. While heteroaromatic systems are, fundamentally, aromatic, the nature

of the heteroatoms introduces a degree of uncertainty, since the heteroatoms tend to localize charges. Heteroatoms in the rings can also localize charges; particularly since the charges are stabilized by the aromatic ring as well (meaning the localization of the anion on the carbonyl oxygen is therefore also unpredictable). As a result, the location of the radical and the charge are unpredictable. Furthermore, as stated previously, since the ring systems can be electron rich, or electron poor, which will further influence the effect of any resonance stabilization, since some heteroaromatic systems may be more stabilizing, while others may be less stabilizing due to charge density.

Furthermore, some heteroaromatic rings are known to open, cleave, or rearrange depending on the nature of the chemical environment, particularly in high-energy systems such as radicals. As a result, while resonance structures for heteroaromatic substituted systems **can** be drawn, the effect of the heteroatoms in the aromatic systems adds a second degree of uncertainty which is not directly comparable to an aromatic hydrocarbon. Given the breadth of the claims encompassing any aromatic or heteroaromatic system, the single example with phenyl substituent cannot be predicted to have the same effect as a heteroaromatic substituent.

4. This, of course, does not even address the question of substituents, which can have other stabilizing or destabilizing effects on the resonance stabilization. The inclusion of all substituents adds a further layer of unpredictability. Generally, hydrogen, and alkyl substituents are neutral with respect to resonance stabilization. Halogens and other heteroatom containing substituents have differing effects depending on the nature of the substituent. Again, the broad claims cannot be supported by the single example.

5. The issue of steric shielding has to do with the ability of the material to propagate the charge from one molecule to the next. If the carbonyl (radical accepting) portion of the compound is sterically shielded too much, then a radical cannot be transferred from one compound to the next (the fundamental of conductivity), without increasing the driving voltage to force the electron into a less favorable orbital. While the example has shown a decrease in driving voltage due to the phenyl substituent, the question of sterics arises when the substituent becomes too large, which is based on the size of the ring, and the size, location and nature of the substituents on the ring. Again, given the breadth of the claims encompassing all possible aromatic rings and substituents adds a degree of uncertainty which cannot be supported by a single example.

6. Examiner agrees that one potential reaction of an acetyl substituted spirobifluorene material would be an aldol-type reaction. Such reactions are well known. Aldol reactions between the acetyl methyl group and another carbonyl would be prevented by the incorporation of an aromatic (or even a quaternary methyl group). Applicant states that substituents such as hydroxyl groups can also be deprotonated (which they can, much more easily than methyl ketones), but they do not produce side reactions. This statement is overly general, since whether or not a substituent (even a hydroxyl substituent) would react depends on the nature of the substituent and the chemical environment. In the simplest case, there may not be anything for an oxy anion to react with. However, even the formation of an alkoxy anion due to the reaction of a

radical containing compound with a hydroxyl group will change the chemistry, and have unknown effects on the conductivity of the material. Regardless, the claims are not limited with regards to the substituent, and many substituents can be envisioned which would have significant reactivity, including other ketone containing substituents, benzylic methylenes, and reactive heterocycles. Therefore, the breadth of the claims cannot be supported by a single unsubstituted-phenyl example. In general, alkyl and aromatic substituents tend to be uncreative, though not all (such as benzylic systems). For this reason, the compounds with t-butyl substituents have been indicated allowable, since they would not be predicted to impart additional reactivity on the compound.

7. Given the broad claims, there are several reasons, as described why the scope of the claims cannot be supported by a single example showing an unsubstituted phenyl substituent. As stated prior, the arguments of counsel cannot take the place of evidence. Evidence supporting particular substituents or particular heterocyclic systems, along with claims which are within the scope of the supporting evidence are required.

8. Examiner would like to point out that aromatic hydrocarbons other than phenyl, and alkyl substituents would be supported by the currently presented evidence. Examiner further notes that Applicant has not yet addressed the issue of the number of aroyl substituents on the spirobifluorene ring system (illustrated in claims 6, 8, 9, 12, and 15), nor claims directed towards synthetic intermediates, such as claim 29.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL E. NELSON whose telephone number is (571)270-3453. The examiner can normally be reached on M-F 7:30am-5:00pm EST (First Friday Off).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Callie Shosho can be reached on 571-272-1123. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Examiner
Art Unit 1794

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Supervisory Patent Examiner, Art Unit 1794

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